

CENTER FOR INSTITUTIONAL REFORM AND THE INFORMAL SECTOR

University of Maryland, College Park

Center Office: IRIS Center, 2105 Morrill Hall, College Park, MD 20742
Telephone (301) 405-3110 Fax (301) 405-3020
<http://www.inform.umd.edu/IRIS>

Sufficient Conditions for Rapid Convergence

March 1999

Omar Azfar

Working Paper #230

This publication was made possible through support provided by the U.S. Agency for International Development, under Cooperative Agreement No. DHR-0015-A-00-0031-00 to the Center for Institutional Reform and the Informal Sector (IRIS) and administered by the Office of Economic and Institutional Reform, Center for Economic Growth, Bureau for Global Programs, Field Support and Research.

The views and analyses in the report do not necessarily reflect the official position of the IRIS Center or the U.S.A.I.D.

Author: Omar Azfar, IRIS Center, Department of Economics, University of Maryland, College Park.

SUFFICIENT CONDITIONS FOR RAPID CONVERGENCE

Omar Azfar^{*}

What must a developing country do to grow rapidly? The answer to this question should consist of conditions, that if satisfied, almost always lead to rapid economic growth. We identify a set of “sufficient” conditions for rapid convergence. All market economies that do above average on institutional quality, trade openness and educational enrollment, and avoid high inflations, converge in incomes as fast as regions converge within countries. There are no exceptions to the rule and the convergence regression has a good fit.

1. Introduction

Perhaps the most important question in economics is why some countries remain persistently poor while others prosper. Most reasonable economic theories predict rapid convergence among economies. Rich countries must grow mostly by technological advances, while poor countries can grow by merely imitating rich countries and by importing scarce capital. In contrast, a cursory look at the data shows no evidence of broad convergence in incomes between rich and poor countries. What then prevents the economies of poor countries mimicking the economies of rich ones?

The answer, we believe, is that the governments of many poor countries fail to augment markets and encourage the proper functioning of a market economy. Economics generally takes as given the many institutions, laws and governance that are the almost necessary preconditions for economic growth and prosperity. Economists’ models, which argue that capital should flow to poor countries that are rich in labor and poor in capital, implicitly presume similar property rights and protection of entrepreneurs from public and private predation in all countries. Many states, however, lack these rights and protections and consequently many countries remain poor while others prosper. Similarly, closed economies will not be able to benefit from gains from international trade. Investors will avoid countries which are not open and don’t allow profits to be repatriated, and are likely to be nervous about countries with high inflation. Furthermore, it is widely conjectured that physical and human capital are complementary, and capital may not flow to countries with a poorly educated labor force.

• IRIS Center, Department of Economics, University of Maryland, College Park, MD 20742.
(301) 405 3018, omar@IRIS.econ.umd.edu

This research has been supported through the IRIS Center of the University of Maryland under a cooperative agreement with the Center of Economic Growth of the U.S. Agency for International Development.

Following these arguments, none of which are novel, we divide our sample into the set of countries that perform above the median on ICRG (International Country Risk Guide) measures, trade openness, educational enrollment and avoid high rates of inflation¹, and the set of countries that fails on at least one of these four counts. We show that the subset of countries that performs well on institutional measures, trade openness, educational outcomes and macroeconomic stability is indeed converging without exception at the rate known as the “iron law of convergence” (Barro and Sala-i-Martin 1995).

In an earlier paper Sachs and Warner (1995) show that countries that have followed relatively open trade policies do form a convergence set. However, as they state in their paper, open trade policies are correlated with other market augmenting policies and we have tried to formalize this conjecture by explicitly using cutoffs for all four policy variables. Statistically, our multidimensional cutoff does better than merely using trade openness as a cutoff. But perhaps what is most persuasive about our argument is that it makes more sense a priori. A country that had poor property rights and governance would probably fail to grow despite being open. It is perhaps only slightly less controversial to claim that low levels of education and frequent hyperinflations would retard growth even in open economies with secure property rights.

Finally it seems irresponsible to say “lower your tariffs and everything else will take care of itself”, and it is best to argue for a broad based development strategy that addresses these four policy variables. Sachs and Warner don’t actually say this but they do state that

Trade liberalization not only establishes powerful direct linkages between the economy and the world system, but also effectively forces the government to take actions on other parts of the reform program under the pressures of international competition.

Perhaps for this reason, much of their paper is written in a tone that suggests trade openness is sufficient for convergence. They do not however explicitly analyze the effects of trade policy reform on factors such as property rights and education, and the direction of causality between macroeconomic stability and openness is questionable. Countries often use fixed exchange rates

¹ We only exclude countries in the top quartile of inflation rates following the widespread theoretical and empirical conjecture in the literature that only high rates of inflation are harmful. Jones and Manuelli NBER No. 4523, Barro 1995, Barro and Gordon 1983, Akerlof et al 1996.

as an anti-inflationary anchor, with concomitant increases in the black market premium, which changes a country's previously open classification to closed.

Their empirical claim that economies that are open for prolonged periods (by their measure) always grow, appears to be true. But three developing economies that were open for over twenty years according to their classification, Jordan, Bolivia and Ecuador grew at 2.58, 2.49 and 2.64 % respectively in their open years. Turkey, Egypt, Pakistan, Tunisia, Mexico and Brazil grew at similar rates despite being closed for most of the period. The growth rates of Jordan, Ecuador and Bolivia in their open periods are far below the rate predicted at their initial GDP in our sample, and far below the growth rate of the slowest growing developing country that did well on all four policy variables, Malaysia at 4.4%. While a developing country that grows at 2.6% per annum is probably converging to developed country incomes (developed economies grow at around 2%), it is converging very slowly. The time it takes to halve the ratio of developed economy (growing at 2%) incomes to its income would be 116 years; a developing economy growing at 4.4% would halve this ratio in 29 years.

It is no surprise that these four measures are correlated with rates of economic growth, but previous analyses have almost all been about averages². We may point out that on average a poor country that performs well on ICRG measures grows more rapidly than rich countries, but a skeptic would point out that many countries with good institutional measures do not grow rapidly, so there must be something wrong or at least missing in that story. The same can be said of each of the four variables. But if we restrict our attention to countries that performed better than average on all measures, we find that *all* poor and middle income countries grow rapidly. We do not want to make the strong claim that developing countries that adopt the four good policies we have mentioned will always grow rapidly. There are perhaps excesses of misfortune or mismanagement (eg. apartheid or very high tax rates), that would retard growth in countries that appear to be making good policy choices on our mechanical classification. We do conjecture however, that conditional on avoiding these excesses, countries that follow enlightened policies on the four variables we have mentioned, over prolonged periods, will converge to developed country incomes.

² An exception is Sachs and Warner (1995) which we discuss at length.

2. Data Description

We use a world-wide cross-country data set that excludes the formerly communist economies. The central question we want to address is the relationship between per capita GDP growth and initial levels of GDP for countries where governments augment markets by

1: providing property rights and the rule of law and desisting from expropriation measured by the ICRG,

2: allowing international trade measured either according to Sachs and Warner's definition or a weighted (by the inverse of the standard deviation) average of their measure, (Imports+Exports)/GDP and the black market premium

3: providing education measured as the sum of primary and secondary enrollment in 1960

4: providing a stable currency measured by the weighted (by the inverse of the standard deviation) sum of inflation and the standard deviation of inflation (macroeconomic stability).

Table 1

Variable	N	Mean	Std Dev	Min	Max.	Median
Growth 60-92	92	1.84	1.65	-2.0	6.70	0.018
GDP 1960	92	2567	2395	257.0	9895	1585
Log(GDP60)	92	7.451	0.901	5.549	9.19	7.36
ICRG82	92	28.23	12.93	8.000	50.0	25.55
Primary enr60	92	0.771	0.330	0.050	1.44	0.83
Second. enr60	92	0.227	0.218	0.003	0.86	0.15
Prim+Sec enr60	92	0.999	0.509	0.053	2.04	1.01
Years Open 60-90	92	0.368	0.347	0.00	1.0	0.249
(Exp+Imp)/GDP	92	0.595	0.323	0.126	1.83	0.517
Black Mkt Prem 60-90	92	69.42	238.6	-0.530	2124	11.66
Open+(X+M)-BMP	92	2.548	1.881	-6.182	8.37	2.51
(X+M)-BMP	92	1.548	1.450	-7.077	5.66	1.438
Mean Inflat. 60-90	92	47.42	134.4	-4.270	767.7	11.54
Std. Dev. Inf. 60-90	92	103.5	426.8	2.100	2616	7.375
Mean + Std. Inf.	92	0.595	1.986	-0.007	11.6	0.098

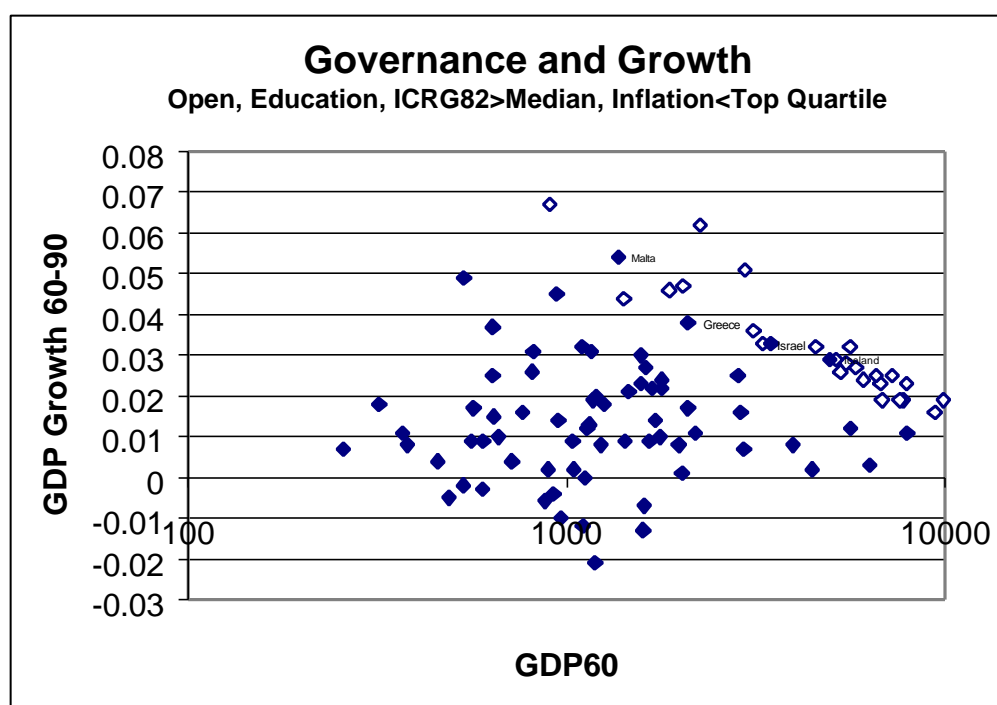
Restricting the data set to countries where all these variables are present leaves us a sample of 92 countries. These four variables each represent a component of broadly defined governance and it is no surprise that they are strongly correlated. Enlightened regimes are perhaps likely to be enlightened on all components of governance. There are 24 countries that perform above the median on ICRG (International Country Risk Guide) measures, trade openness, and educational enrollment and avoid the top quartile of the inflation measure. We

used the median rather than the mean as the cutoff point to avoid sensitivity to outliers, which are quite high for some variables (e.g. inflation). Table 1 provides the summary statistics for the variables in the data set.

3. Sufficient (and Necessary?) Conditions for Convergence

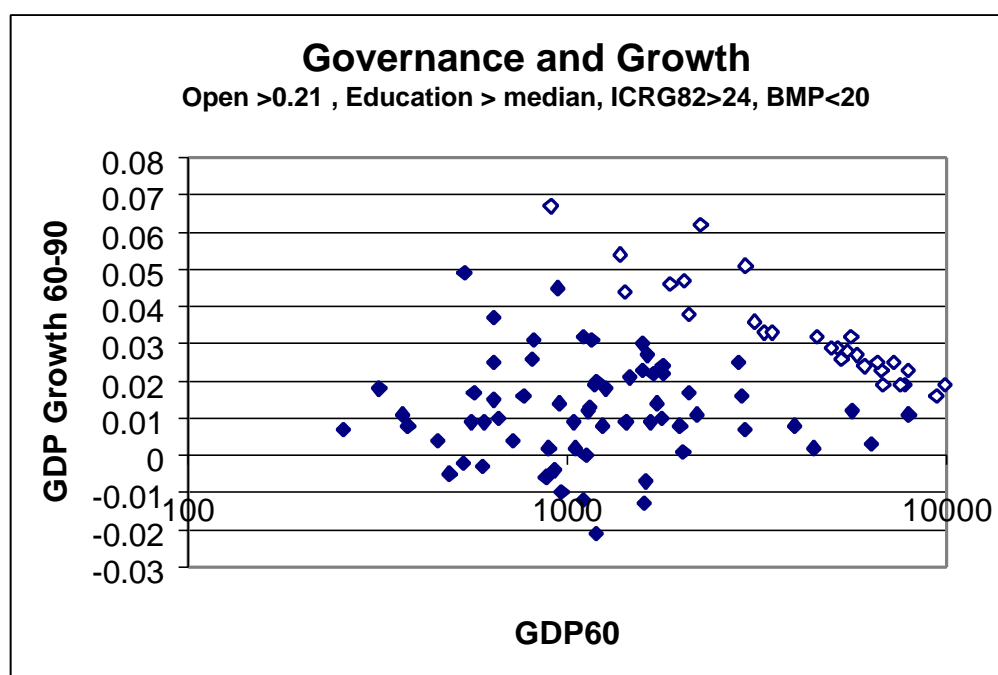
Figure 1 shows that poor and middle income countries where government perform well on our four measures of market-augmenting government -- i.e., ICRG measures, educational enrollment, trade openness and a low black market premium are **all** growing rapidly and their incomes are converging to those of high-income countries. The white dots in the graph below represent countries that do above average on all measures of governance and the black dots represent countries that do badly on at least one. There is a clear pattern that poor countries that do well on all measures invariably grow faster than richer countries. That there are no white dots in the lower left two-thirds of the graph, provides evidence that a good performance on institutions, education, trade openness and macroeconomic stability are sufficient conditions for convergence.

Figure 1



These conditions are close to being necessary and sufficient. Of the four exceptions to “necessity” (Greece, Malta, Ireland and Israel), Greece and Malta are very marginally excluded from the set of countries that do above average on the institutional variables. If we change the boundary slightly, we would include Greece and Malta in the set of countries we expect to converge and bring in no other countries that are not converging. Independent measures are available for Greece between 1972 and 1989 from the “Business environment research institute” (BERI), also used by Knack and Keefer (1995), which suggest institutions were on average much better than suggested by the ICRG score in 1982³. Greece also scores above the median on the smaller sample for which the BERI numbers are available. Malta’s BERI scores were not available, but homicide and assault rates (which are correlated with the rule of law variable) are, like Greece, much lower than the world average.

Figure 2



Israel and Iceland do poorly on inflation measures, but can be distinguished from other countries with high inflation by their having relatively low black market premiums. Had we used the black market premium <20% as our macro variable, we would include them in our “expected to converge” set and not any other countries that are doing poorly. Perhaps inflation

³ We regressed the average BERI scores between 1972 and 1989 on the ICRG scores. The equation has a good fit

only seriously affects economic performance if inflation or the policies to combat it lead to distorted foreign exchange markets.⁴ In fact, Israel also barely fails the trade openness test based on Sachs and Warner's measure, but their rating is questionable. They classify Israel as a closed economy until 1985, while it had essentially open trade with Europe and America since 1975 and had a ratio of Imports+Exports/GDP=0.71. Thus minor variations in our methods of parsing the data would allow us to define necessary and sufficient conditions for rapid convergence (Figure 2).

Sachs and Warner also find “necessary and sufficient” conditions for convergence but their findings are weaker than ours. The slowest growing poor country in their converging sample is Jordan growing at 2.6% while the slowest growing poor country in our sample is Malaysia at 4.4%. Moreover a stringent enough requirement on years open by their measure to exclude Bolivia (growing at 1.3%) would exclude Korea, Taiwan⁵ and Japan. Bolivia does poorly on all three other variables so it is no surprise to us that it did not grow rapidly (it is missing in the convergence graphs in Sachs and Warners paper, pgs. 42 and 43).

4. Trade openness

We used Sachs and Warner's measure to parse our data. Sachs and Warner classify a country as closed if it has high tariffs, pervasive non-tariff barriers, a high black market premium, a state monopoly on major exports or a socialist economic system (the last condition is irrelevant for us since we don't have the socialist economies in our data). They make a number of subjective calls and rely on other sources, which may have classified a country as open if it was doing well and not otherwise. This measure is highly correlated with two of the other policy variables, education and institutions. In fact its much more correlated with these variables than it is with objective measures of trade openness such as (imports+exports)/GDP, and (imports+exports)/GDP adjusted for population size, or structure adjusted trade intensity (Pritchett 1996 following Chenery and Syrquin 1989).

($R^2=0.72$). Greece's BERI scores were well above the line of best fit.

⁴ Alternatively inflation may be one of the factors investors look at to gauge general competent government and in a country with otherwise near perfect governance such as Iceland (it scores 46/50 on the ICRG measure) high levels of inflation would not scare away investors. Israel, the other successful high inflation country had large loan guarantees at the time of its hyperinflation, which may have reduced investors' sensitivities to signals given by the inflation rate.

⁵ Taiwan and Singapore are unfortunately missing from our sample because data on (Imports+Exports)/GDP was missing. They would certainly be part of the converging set of economies at growth rates above 6% and would easily satisfy all requirements to be in the “expected to converge” set.

It is difficult to distinguish the effect of each of the four variables, because of the high degree of correlation between countries that do well on the four criteria. The only two countries excluded by trade openness alone are South Africa and New Zealand.

New Zealand is a rich country growing at a slower rate than other rich countries. Its inclusion in a sample of converging countries may therefore not reduce the rate of convergence, but perhaps the example can inform us about the importance of trade openness. However, it seems that New Zealand's low scores on trade openness do reflect economic policies that were also distortionary otherwise. Indeed trade reform is one of many components of New Zealand's celebrated reforms (Evans et al 1996). So New Zealand's low score on trade openness does not provide convincing evidence of the importance of trade openness in achieving economic growth and prosperity. South Africa too does not provide entirely convincing evidence as its scores on education are borderline, and the economic costs of social stratification caused by apartheid may have been large. We discuss South Africa at length later in this section.

Furthermore, New Zealand and South Africa don't do too badly on objective measures of trade openness such as $(\text{imports} + \text{exports})/\text{GDP}$ or the black market premium (though New Zealand does perform poorly on size adjusted trade intensity). Thus this way of parsing the data does not provide convincing evidence for the claim that trade openness is necessary for economic growth, even though it is broadly suggestive that the two countries that are disqualified from the "expected to converge club" on the basis of being closed do worse than the countries in the club. A multiple regression, however, does clearly show the importance of trade openness even after controlling for other factors (Table 2), supporting our conjecture that trade openness matters but is not all that matters.

Sachs and Warner divide their data into countries with and without open trade policies and show that the subset of open countries converges. Alternatively we could show that the subset of countries with good institutions, educational enrollment and low or moderate inflation converges just as fast or faster. Table 2 contains convergence regressions from a sample of countries that avoided high inflations and performed above the mean on institutions (ICRG) and education (2.1); and on a sample of countries that was open for half the period (2.2). The sub-sample open for three fourths of the period is in Table 3, equation (3.2). The rate of convergence is a little higher in the sample that does above average on institutions, education and macroeconomic stability. The samples are actually quite similar as the Sachs and Warner

measure is very highly correlated with getting the other three variables right (Correlation coefficient=0.73). Regressions 2.3 and 2.4 include the entire sample. In these regressions, both trade openness and the other three policy variables matter, supporting our intuition that trade openness matters but is not the only thing that matters.

Table 2

Dependant variable: Per capita GDP Growth 1960-1992

	2.1 Institutions Education Inflation	2.2 Trade Open > 0.5	2.3 Full Sample	2.4 Full Sample
Constant	18.4	14.7	7.6	7.36
Log(GDP60)	-1.82 (6.54)	-1.48 (4.52)	-1.18 (4.36)	-1.2 (4.33)
Years Open			2.63 (4.84)	
BMP +(Imports+Exports/GDP)				0.27 (3.02)
Primary+Secondary Enrollment 1960			1.66 (3.34)	2.27 (4.53)
ICRG 1982			0.017 (1.143)	0.033 (2.12)
Mean+ Std. Dev. of Inflation			-0.138 (2.122)	-0.012 (0.166)
N	26	31	92	92
Adj R ²	0.63	0.39	0.49	0.42
(t statistics below coefficients)				

Countries in the top quartile of alternative measures of openness such as (imports+exports)/GDP (adjusted or not for size etc.) don't show any pattern of convergence (equation 3.3). We might therefore want to check for whether our mechanism for finding sufficient conditions for convergence is robust to changing the measure of openness.

The only difference this makes is that South Africa which is not converging, gets included in our "expected to converge" sample. This is not overly worrisome, given South

Africa's unique history. South Africa's economic system was geared to white economic advancement rather than general economic development. Abedian and Standish (1992) report that the system of apartheid produced poor economic outcomes, including perhaps the world's most skewed income distribution⁶, and poor educational outcomes, which may have compounded the shortening of investment horizons and the productivity of investment. However they also blame South Africa's increasingly unsuccessful import substituting policies for some its slow growth. In sum, it appears that, given the evidence of sanctions and import substitution, South Africa was more closed, and benefited less from trade than its trade intensity (import+export/GDP) numbers indicate, and this partially explains South Africa's slow growth. But this doesn't appear to be the whole story, the direct costs of apartheid, the consequent poor educational outcomes and income inequality all may have retarded South Africa's growth.

5. Institutions

The security of property rights and the efficiency of government provision of public goods complementary with private enterprise are likely to affect economic performance. Income and welfare in anarchic areas are so low that people flee them (or would like to) to places with functioning governments. Economic theory clearly predicts that fears of expropriation of private property either by governments or other people would reduce productive activity, especially if it had a prolonged gestation period. Keefer and Knack (1995) introduced a new set of institutional variables from the International Country Risk Guide to the economics literature. The index is a sum of The Rule of Law, Repudiation of Contracts, Expropriation Risk, Corruption and The Quality of Bureaucracy, each graded between 0 and 10. (Low numbers are bad, i.e, a low number for Corruption means there is a lot of corruption, and a low number for Quality of Bureaucracy means the quality of the bureaucracy is poor).

Many recent papers on the subject have documented the effects of institutional variables on economic activity (Keefer and Knack 1995, Barro 1997, Levine 1997, Levine 1999, Easterly and Levine 1997, Mauro 1995). Some of these papers have used indices of social division such

⁶ They report a Gini coefficient of 0.71, higher than the highest Gini coefficient of 0.65 reported by the World Bank for countries in which reliable data was available, and significantly higher than the highest in our expected to converge sample, Malaysia at 0.5. Mauro (1995) and Easterly and Levine (1997) document the effect of social stratification on economic performance and Benabou (1996) provides a theoretical analysis of this question.

as income distribution and ethnic fractionalization as instruments for poor governance⁷. Levine and others have identified financial development as one possible mechanism for the effect of market augmenting governance on economic performance.

Do institutional variables measure market-augmenting government or merely reflect past economic performance? While we cannot econometrically resolve this issue, there are historic episodes, which suggest that at least on occasion, policy reforms preceded and caused improvements in economic performance. Klitgaard (1988) reviews four episodes of successful anti-corruption reform in his book “Controlling Corruption”, three of which, in Taiwan, Hong Kong and Singapore were followed by three of the most successful episodes of economic growth in history. At a broader level, to paraphrase Olson et al (1999), the changes in government when Park replaced Rhee, Suharto replaced Sukarno, and Chiang Kai Chek changed economic policy in Taiwan in the 1960’s, appear to be causes rather than consequences of economic growth. In addition, Sachs and Warner persuasively argue for the ideological and historic roots of policy choices, which would suggest they are exogenous for our purposes. In summary, while we don’t want to argue that governance is exogenous in the strong sense that it is not affected by economic performance, it does appear that sometimes the quality of governance changes independently of prior economic growth and these changes are often followed by improvements in economic performance.

Knack (1996) explicitly tests for convergence among the countries that perform well on the ICRG variable and finds that these countries do converge. The estimated equation is

$$\text{GDP Growth 60-89} = 5.84 - 0.834 \text{ Log(GDP60)} \quad R^2=0.58 \\ (5.77)$$

This sub-sample displays convergence, but there are several counterexamples to the hypothesis that this measure by itself explains all the variation in growth rates. While no country with poor institutions has grown truly fast, there are a number of countries with middling institutions that have grown rapidly, and others that outperformed them on institutional measures have not done remarkably well. Korea, Malta and Greece score around the median of the ICRG range and all are clearly within the convergent set but are outperformed on the institutional variables by Papua New Guinea, Chile, Ecuador and Trinidad all of whom are clearly outside the

⁷ Admittedly these studies are not entirely convincing. Ethnic fractionalization or income distribution may have other effects on economic performance, which would invalidate them as instruments. Indeed, some of Mauro’s

set of converging countries⁸. All these countries perform badly on one of the other three measures, Papua New Guinea on education and trade, Trinidad on trade (and very marginal educational scores), Chile on macroeconomic stability and perhaps trade⁹, and Ecuador on education and macroeconomic stability. On the other hand, the three countries that are clearly part of the convergent set on the GDP levels and growth locus, qualify on all other variables.

A number of countries do well on all counts except ICRG measures. Besides Malta and Greece, which only very marginally fail to satisfy the ICRG requirement, the other countries Guyana, Suriname, Jamaica, Jordan, Panama, Gabon and Sri Lanka do not do too well on the GDP levels/Growth locus. As we discussed earlier, independent measures we have for Greece indicated that the 1982 ICRG level was lower than the period average.

Thus the evidence does suggest that poor institutions can retard economic performance. Furthermore, ICRG measures do appear to increase the growth rate in equations 2.3 and 2.4, and the coefficient is significant in equation 2.4. The coefficient in equation 2.4 suggests that a change in the institutional variable from the median to near the maximum (which is achieved by a number of countries) would raise the rate of growth by 0.8% per annum, or 45% of the mean growth rate in the sample.

Taken together the sum of the evidence suggests that property rights and the rule of law matter, but are not all that matter. But perhaps our statistical tests are a little unfair to the institutional variables. We only use the value of the institutional variable in 1982, the earliest date for which it is available, but ideally would have an average value over the period studied. As the example of Greece suggests, a country can have below average institutions in 1982 and better institutions for most of the sample or vice versa, so we may have overstated the number of examples of countries with good institutions that did poorly, or countries with poor institutions that did well.

6. Education

That wages rise with education is perhaps the most robust empirical finding in economics. Indeed it is so robust that few papers report results saying that wages rise with

regressions fail to reject the test of overidentifying restrictions.

⁸ All of which are well below the line of best fit in our convergent sample. Thailand both marginally fails to qualify and its GDP adjusted growth rate is a little below the convergent set.

⁹ If we use a composite of the Sachs and Warner measure and the Black market premium, Chile fails the trade test. However we should perhaps not do this as Sachs and Warner's measure includes the black market premium. What

education without saying how much they rise with education. This is in sharp contrast to the usual discussion of the significance of coefficients without a discussion of their value (McCloskey 1996). Furthermore, measured rates of return to education often exceed rates of return to physical capital, and instrumental variable estimates often exceed OLS estimates (Card 1994). In many developing countries the measured rate of return to human capital is higher than in developed economies, and higher than the rate of return to physical capital (Psachoropoulos 1973), which suggests investment in education should increase economic growth. There is, of course, the question of whether these estimates reflect signaling of innate ability rather than true human capital acquisition. As Wise (1995) points out, however, these signals are economically valuable, and even if the coefficients to education reflect signaling, the social return to human capital may exceed the measured coefficients.

Furthermore, it is widely conjectured that physical and human capital are complementary. This conjecture by Nelson and Phelps (1966) has recently found support in the finding that educated people acquire computer skills more rapidly than less educated people. Female education is widely believed to reduce desired and actual fertility levels (Birdsall 1988), slowing the dilution of physical capital.

The interplay between education and institutional performance is a fascinating question too involved to be adequately addressed in this paper. But we will hazard a few conjectures. Countries with good institutions and secure property rights are more likely to attract physical capital. If the story about the complementarity between physical and human capital is true, then this increased investment in physical capital should induce more investment in human capital. Education is likely to be publicly provided and so better governments are likely to produce better educational outcomes for given enrollment rates. Conversely better education and the subsequently improved civil culture is likely to produce better governance. The lack of broad-based education could lead to social stratification, which is harmful to economic performance in part due to its effect on poor governance.

Finally, it is difficult to imagine a developed market economy without broad-based education, let alone think of one that exists. The sum of the points made above: that the rate of return to education exceeds that of human capital, that education may be complementary with

is surprising is that Chile's much heralded economic performance appears to be only middling in our sample. Even post reform (1980-1992) growth is only 1.9% per annum, less than Pakistan, Turkey and India.

physical capital, that the education of girls is likely to reduce desired fertility and the consequent capital dilution, and that the institutions of governance which are important for economic performance, may not be sustainable in a poorly educated country, must lead us to believe that education is important for economic development. Regression 2.3 and 2.4 in Table 2 shows a statistically and economically significant effect of education on economic performance. (A change in the sum of enrollment rates from 1 to 2 would raise the growth rate of GDP by 1.66% or 2.27%). Indeed, secondary enrollment is one of the few variables that survives Levine and Renelt's scrutiny in their seminal (1992) paper.

There are only three countries, Gambia, Thailand and Botswana that perform below the median on education and would otherwise qualify. In addition, both Gambia and Botswana only qualify marginally on trade openness on the Sachs-and-Warner measure, though both have very high measures for trade as a proportion of GDP (the sum of imports and exports equals GDP for both countries). Thailand barely fails to qualify on the educational measures (it scores 0.95 and the cut off is 1.00) and is a marginal member of the convergence club. (Its per capita growth rate is 4.5%, thus while it is clearly growing faster than developed countries, it is not growing as fast the Asian Tigers all of whom do 15% better than Thailand on educational enrollment).

Botswana performs poorly on educational enrollment (though not on outcomes, the literacy rate is 75%) and is not an open economy for most of the period, yet it is the African Miracle, growing at 4.9 % from 1960 to 1992. However we must remember the base of Botswana's 1960 income was so low that its 1992 income is not high. The growth rate, while impressive, is well below the rate predicted by equation (3.1). In addition there was a large discovery of diamonds in Botswana that may have raised its income. Many African countries have such poor institutions that they can't even efficiently extract natural resources, and Botswana's governance may have been enough for this economic activity (it qualifies on the institutional measures after all), but its an open question whether, in the absence of widespread education and opening the economy, this would be enough to make Botswana a developed country. Reassuringly end-of-period enrollment rates (above 1.28 by our measure) are quite high and a little above the enrollment rates in the Asian Tigers in 1960, and Botswana has been open since 1979 by the Sachs and Warner measure.

7. Macroeconomic Stability

Of the four policy variables we consider necessary for rapid convergence, macroeconomic stability is perhaps the most controversial. Economists are hard pressed to think of serious costs of moderate inflations, they often assume square costs of inflation, and a low positive rate of inflation may even be beneficial for wage flexibility. Barro 1995 finds that inflation rates below 20% had a much smaller effect on economic growth than higher rates (in fact there is little evidence they had any effect at all). Following these arguments we only excluded a country from the expected to converge set if it was in the top quartile of our inflation measure. Had we used the median we would have excluded Korea, Spain, Portugal, Italy and the United Kingdom, all of which do well on growth. There are no countries that do well on all other measures and have moderate inflation rates and perform poorly.

The effects of high inflations appears to be erratic. Ecuador and Chile do well on all other measures and have high inflation rates and disappointing growth rates (2.1% and 1.6%). Israel and Iceland however do well despite high inflation rates. If we use the black market premium rather than inflation, a cutoff at 20% excludes the two Latin American countries but keeps Israel and Iceland in. Perhaps inflation only seriously affects economic performance if inflation or the policies to combat it lead to distorted foreign exchange markets. It's also possible that the inflation variable sometimes shows up as important because the debt crises both raised inflation rates and retarded growth in Latin America. Because the debt crises would also have raised the black market premium, using the black market premium as the "macro variable" allows us to parse the data into successful and unsuccessful countries. In fact three of the four countries excluded by inflation measure, Israel, Chile and Costa Rica do worse during their hyperinflations than at other times (Bruno and Easterly 1998). Costa Rica does much worse and its hyper-inflation coincides with the debt crises. Iceland does much better before its inflationary period, but also has slow growth for a prolonged post-inflationary period.

8. Convergence

Most reasonable theories of economic growth predict convergence among countries. But all these theories implicitly assume good policies that underlie successful market economies. A more thoughtful statement of the convergence hypothesis would predict convergence among a set of countries that make the right policy choices.

Table 3 shows that the set of 24 countries that do above average on our policy variables does indeed converge strongly. The set of 24 countries that was open for more than three quarters of the period by Sachs and Warner's measure also converges strongly but only 60% as fast as our sub sample that does well on the four variables. The two samples are quite similar: Korea, Japan, Ireland and Australia are in the four policy variables sample and not the years open >0.75 sample. Conversely Greece, Ecuador, Thailand and Iceland are only in the years open >0.75 sample. (Taiwan is excluded from our data set because of some missing data and would almost certainly satisfy the "four variables" requirement, but not years open>0.75, it is open for 0.71 of the period; weakening the years open requirement to allow Taiwan in the expected to converge set would mean letting in slow growing Bolivia). Figure 3 and Figure 4 show the pattern of convergence in the two samples.

Table 3
Convergence in three subsamples

Dependant variable: Per capita GDP Growth 1960-1992

	3.1 Four variables	3.2 Trade Open (S&W) >0.75.	3.3 Top 24 (X+M)/GDP
Constant	20.0	13.6	-0.69
Log(GDP60)	-2.019 (11.398)	-1.362 (6.810)	0.408 (0.855)
N	24	24	24
Adj R ² (t statistics below coefficients)	0.85	0.54	-0.01

The fit of the regression in the sample with countries doing well on all variables is very high ($R^2=0.85$) and there are no exceptions to the rule of rapid convergence. The fit of the regression and the speed of convergence are similar to those found in convergence between regions within developed countries (Barro and Sala-i-Martin 1995). Countries do of course provide similar policies to all regions within them. It seems that as a consequence there is rapid, inevitable convergence within them. In Barro and Salai-Martin's data there does not appear to

be any relatively poor region in Japan, The United States or Europe that was not catching up with its peers. The same appears true of countries that follow good policies.

Figure 3

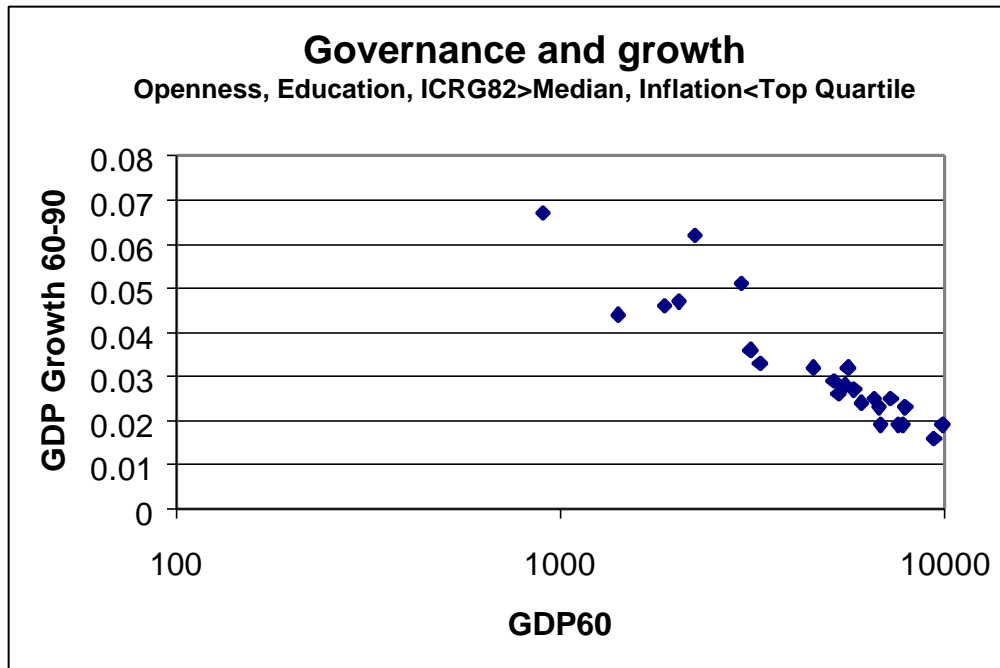
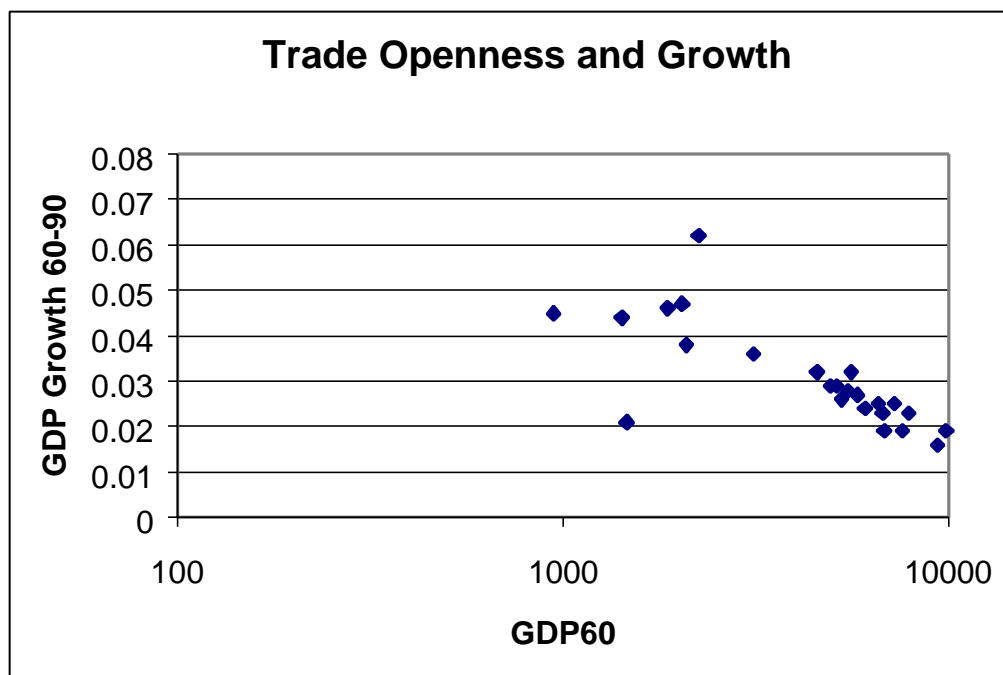
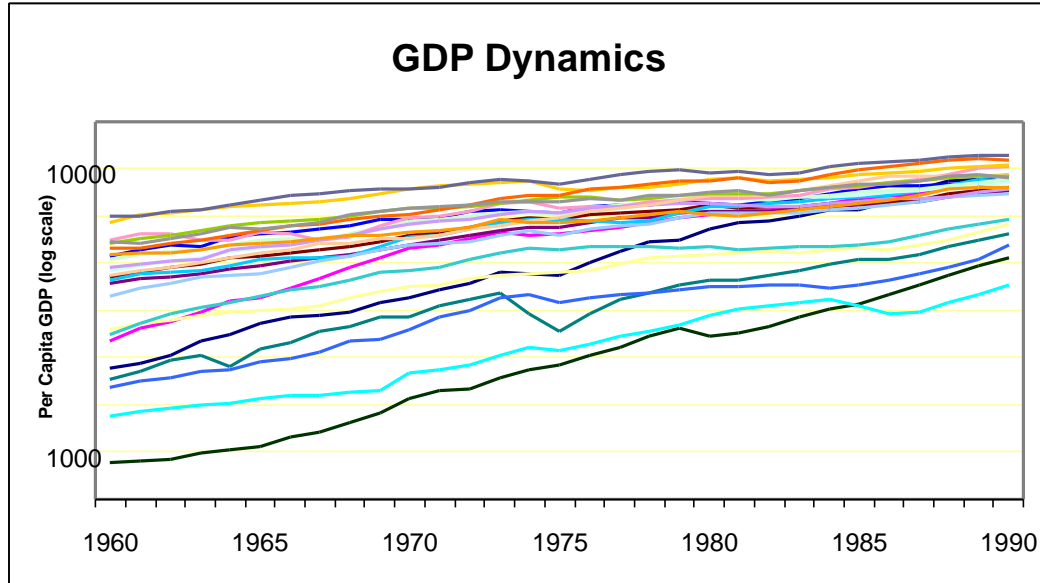


Figure 4



A negative coefficient on initial income is of course not sufficient to show convergence in incomes because it may be caused by measurement error or temporary deviations from trend income like business cycles (Galton's fallacy). However if Galton's fallacy is the cause of the negative coefficient then the variance in log per capita GDP should not decline with time. Figure 5 shows a clear pattern of convergence the time series of log per capita GDP over time for our "expected to converge set", and Figure 6 shows the time series of the variance in per capita GDP. This variance declines by a factor of 4 over our sample, much like the decline in the variance of log per capita GDP across American States and Japanese prefectures (Barro and Sala-i-Martin 1995). Similarity of policies thus may be sufficient to explain convergence both within and across countries.

Figure 5



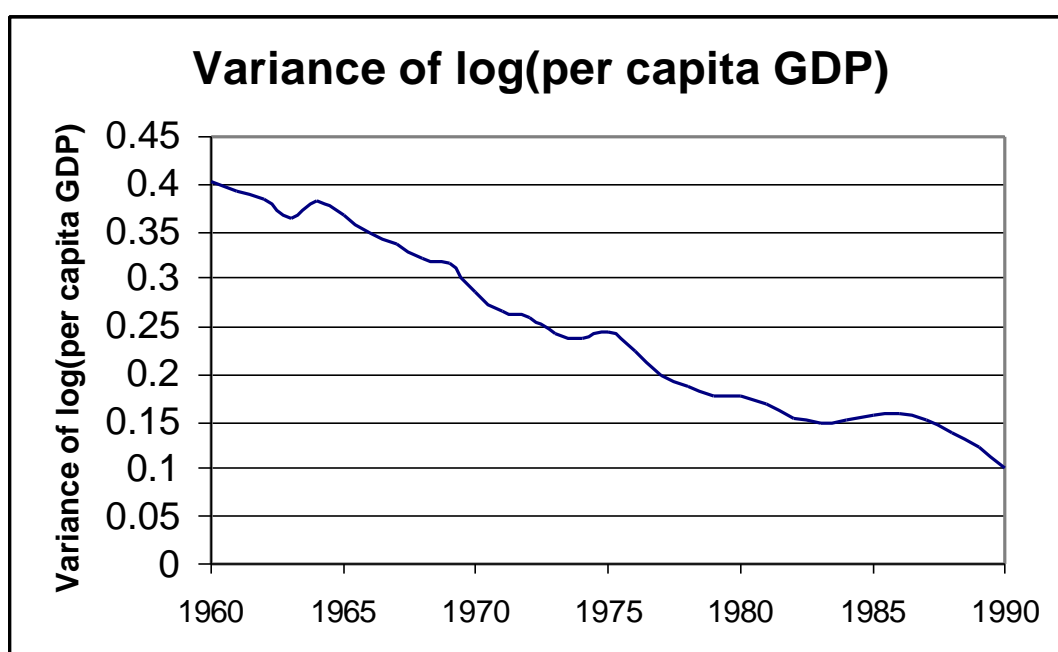
9. Conclusion

As development economists we are often asked what a country must do to grow rapidly. The answer to this question should consist of conditions that, if satisfied, almost always lead to rapid economic growth. In a very real sense the right question to ask is “What are the sufficient conditions for rapid economic growth?” In this paper we identify a set of conditions, that if satisfied, invariably lead to rapid convergence.

We showed that all market economies that do above average on institutional quality, trade openness and educational enrollment, and avoid high inflations, converge in incomes as fast as regions converge within countries, at the rate known as the iron law of convergence. There are no exceptions to the rule and the convergence regression has a good fit.

At a broad level it is institutions of governance that determine which economies languish and which prosper. All four variables we have identified as important for entering the convergence club are policy variables. Governments decide whether economies are open, whether property rights are protected and laws enforced, whether education is broadly accessible and whether to tolerate high inflations. We suspect that it is as a consequence, that there are broad and conspicuous differences in income and well being across international borders.

Figure 6



We are still left with the mystery, the “big bills” question (Olson 1996) of why, if satisfying these requirements is all that stands between a poor country and prosperity, they do not all adopt good policies. The answer is perhaps that collective action problems need to be solved for good policies to be enacted, and whether or not collective action succeeds is in some measure a matter of chance. Big bills can be left on the sidewalk if it takes collective action to pick them up.

However, clarity of exposition about what determines economic growth and an answer to the question

“What must a country do to grow rapidly?”

may increase the probability that good policies get adopted. Failures of collective action thrive best behind the smoke and mirrors created by those that have a narrow interest in these failures. Clarifying that all poor and middle income economies that adopt certain policies have grown rapidly, may facilitate in achieving the political momentum to adopt them, and made it a little harder to thwart them.

References

- Abedian, Iraj and Barry Standish, The South African economy: an historical overview, in *Economic Growth in South Africa: Selected policy issues*, Oxford University Press 1992.
- Akerloff, George., William Dickens and George Perry, The macroeconomics of low inflation, *Brookings Papers on Economic Activity* 1996.
- Barro, Robert and Xavier Sala-i-Martin (1995). *Economic Growth*. (New York: McGraw-Hill).
- Barro, Robert, Determinants of Economic Growth, MIT Press 1997.
- Barro, Robert and David Gordon, Rules discretion and reputation in a model of monetary policy, *Journal of Monetary Economics*, 1983.
- Benabou, Roland, Inequality and growth. *NBER Macroeconomics Annual* 1996.
- Birdsall, Nancy, Economic approaches to population growth, in the Handbook of development economics Vol1 1988.
- Bruno, Michael and William Easterly, Inflation crises and long-run growth. *Journal of Monetary Economics* 1998.
- Card, David., Earnings, schooling and ability revisited, *NBER Working Paper October* 1994.
- Chenery, Hollis and Moises Syrquin, Three decades of industrialization, *World Bank Economic Review* 1989.
- Easterly, William, and Ross Levine, Africa's growth tragedy: Policies and ethnic divisions, *QJE* 1997.
- Evans, Lewis, Arthur Grimes, Bryce Wilkinson with David Teece, Economic reform in New Zealand 1984-95: The pursuit of efficiency, *Journal of Economic Literature* 1996.
- Jones, Larry. and Rodolpho Manuelli, Growth and the effects of inflation, NBER Working Paper No. 4523, 1993.
- Klitgaard, Robert, Controlling corruption, *University of California Press*, 1988.
- Knack, Stephen. "Institutions and the Convergence Hypothesis: The Cross-National Evidence." *Public Choice* 1996.
- Knack, Stephen and Philip Keefer (1995). "Institutions and Economic Performance: Cross-Country Tests Using Alternative Institutional Measures." *Economics and Politics*, 7:3, 207-27.

- Levine, Ross and Renelt, David (1992). "A Sensitivity Analysis of Cross-Country Growth Regressions." *American Economic Review*, 82:4, 942-63.
- Levine, Ross, Financial development and economic growth: views and an agenda, *Journal of Economic Literature* 1997.
- Levine, Ross, Napoleon, bourses and growth: With a focus on Latin America. *Mimeograph prepared for the IRIS Conference on Market-augmenting government*.
- McCloskey, Diedre, The standard error of regressions, *Journal of Economic Literature* 1996.
- Mauro, Paolo, Corruption and Growth, *Quarterly Journal of Economics*, 110, 681-712, 1995.
- Nelson, Richard and Edmund Phelps, Investment in humans, technological diffusion and economic growth, *American Economic Review* 1966.
- Olson, Mancur., Big bills left on the sidewalk: Why some nations are rich and others poor. *Journal of Economics Perspectives* 1996.
- Olson, Mancur, Naveen Sarna and Anand Swamy, Governance and growth, *Public Choice forthcoming* 1999.
- Pritchett, Lant., Measuring outward orientation in LDCs: Can it be done? *Journal of Development Economics* 1996.
- Psacharopoulos, George, Returns to education, *Jossey Bass/Elsevier* 1973.
- Sachs, Jeffery and Andrew Warner, Economic reform and the process of global integration, *Brookings Papers of Economic Activity* 1995.

	Country	GDP60	GDP Growth	Years Open	(X+M) /GDP	ICRG82	Prim.	Sec.	Enr.	Mean Inf.	Std. Dev. Inf.	Mean +SD Inf.	BMP	Dummies for Years Open, ICRG, Enrollment and Inflation.
1	Turkey	1622	0.027	0.133	0.228	25.00	0.75	0.14	0.89	40.05	24.59	0.355	23.42	0 0 0 0
2	Somalia	1103	-0.012	0.000	0.560	22.00	0.09	0.01	0.10	29.84	26.06	0.283	37.07	0 0 0 0
3	Nigeria	567	0.017	0.000	0.329	14.20	0.36	0.03	0.39	19.05	14.91	0.176	79.99	0 0 0 0
4	Zaire	489	-0.005	0.000	0.488	12.10	0.60	0.03	0.63	53.55	30.11	0.468	104.03	0 0 0 0
5	Zambia	965	-0.010	0.044	0.820	20.03	0.48	0.01	0.49	30.48	34.30	0.307	111.12	0 0 0 0
6	Tanzania	319	0.018	0.000	0.462	20.63	0.28	0.02	0.30	21.63	10.11	0.184	127.16	0 0 0 0
7	Uganda	598	-0.003	0.156	0.382	13.50	0.49	0.03	0.52	115.31	72.03	1.026	255.02	0 0 0 0
8	Ghana	894	0.002	0.222	0.351	14.50	0.59	0.03	0.62	45.26	35.77	0.420	324.50	0 0 0 0
9	Madagascar	1191	-0.021	0.000	0.355	25.33	0.52	0.04	0.56	13.68	8.65	0.122	26.96	0 0 0 1
10	Egypt	809	0.026	0.000	0.486	13.50	0.66	0.16	0.82	13.22	5.98	0.112	40.77	0 0 0 1
11	Banglade	952	0.014	0.000	0.214	10.83	0.47	0.08	0.55	15.69	14.99	0.151	117.61	0 0 0 1
12	Iran	2946	0.007	0.000	0.690	8.00	0.41	0.12	0.53	15.71	7.85	0.135	335.82	0 0 0 1
13	Liberia	717	0.004	0.010	0.981	11.00	0.31	0.02	0.33	7.66	5.96	0.070	0.00	0 0 0 1
14	Senegal	1047	0.002	0.000	0.692	22.67	0.27	0.03	0.30	8.22	8.13	0.080	2.16	0 0 0 1
15	Togo	367	0.011	0.000	0.855	18.50	0.44	0.02	0.46	7.11	7.53	0.070	2.16	0 0 0 1
16	Haiti	924	-0.004	0.000	0.373	8.40	0.46	0.04	0.50	8.94	7.98	0.085	12.82	0 0 0 1
17	Kenya	659	0.010	0.044	0.596	24.17	0.47	0.02	0.49	11.34	4.84	0.095	16.69	0 0 0 1
18	Tunisia	1101	0.032	0.133	0.645	23.50	0.66	0.12	0.78	7.15	2.50	0.059	33.10	0 0 0 1
19	Pakistan	638	0.025	0.000	0.287	13.00	0.30	0.11	0.41	9.70	6.57	0.087	45.85	0 0 0 1
20	Ethiopia	257	0.007	0.000	0.268	22.67	0.05	0.01	0.06	7.26	8.89	0.074	82.70	0 0 0 1
21	Algeria	1723	0.014	0.000	0.566	19.50	0.46	0.08	0.54	9.14	4.03	0.077	147.70	0 0 0 1
22	Guinea	559	0.009	0.200	0.472	20.67	0.30	0.02	0.32	-4.27	10.40	-0.007	253.32	0 0 0 1
23	Uruguay	3968	0.008	0.111	0.329	24.43	1.11	0.37	1.48	63.23	22.92	0.524	12.47	0 0 1 0
24	Dom. Rep.	1195	0.020	0.000	0.485	25.50	0.98	0.07	1.05	18.22	15.99	0.173	36.92	0 0 1 0
25	Argentina	4462	0.002	0.089	0.187	25.30	0.98	0.32	1.30	466.30	794.31	5.329	49.40	0 0 1 0
26	Suriname	1983	0.008	0.167	1.126	15.33	1.10	0.28	1.38	12.13	11.68	0.117	0.00	0 0 1 1
27	Philipp.	1133	0.012	0.156	0.389	13.03	0.95	0.26	1.21	14.79	11.24	0.136	10.85	0 0 1 1
28	Paraguay	1177	0.019	0.133	0.368	21.03	0.98	0.11	1.09	17.72	9.76	0.154	26.25	0 0 1 1
29	Guyana	1596	-0.013	0.156	1.284	10.07	1.07	0.43	1.50	15.45	9.54	0.137	265.10	0 0 1 1
30	Gabon	1789	0.022	0.000	0.890	19.90	1.00	0.05	1.05	8.96	7.78	0.084	1.86	0 0 1 1
31	Mexico	2836	0.025	0.200	0.208	30.67	0.80	0.11	0.91	42.94	38.20	0.408	5.05	0 1 0 0
32	Colombia	1684	0.022	0.089	0.278	27.00	0.77	0.12	0.89	22.50	5.66	0.180	7.91	0 1 0 0
33	Sierra L.	878	-0.005	0.000	0.530	27.00	0.23	0.03	0.26	42.21	45.39	0.420	94.96	0 1 0 0
34	Gambia	602	0.009	0.222	1.069	28.00	0.12	0.03	0.15	14.26	11.76	0.133	8.21	0 1 0 1
35	Trinidad	5627	0.012	0.000	0.900	30.17	0.78	0.22	1.00	12.11	4.17	0.099	19.76	0 1 0 1
36	Malawi	380	0.008	0.000	0.589	25.60	0.63	0.01	0.64	16.31	7.78	0.139	43.00	0 1 0 1
37	Burkina	456	0.004	0.000	0.458	25.67	0.08	0.00	0.08	6.45	8.76	0.068	2.16	0 1 0 1
38	Cameroon	641	0.015	0.156	0.477	26.00	0.65	0.02	0.67	9.58	4.70	0.082	2.16	0 1 0 1
39	Niger	532	-0.002	0.000	0.383	30.00	0.05	0.00	0.05	6.86	9.07	0.072	2.16	0 1 0 1
40	Cote d'Iv.	1120	0.000	0.000	0.705	30.00	0.46	0.02	0.48	9.19	7.22	0.085	2.16	0 1 0 1
41	Papua N.G.	1235	0.008	0.000	0.787	33.67	0.32	0.01	0.33	7.48	4.39	0.065	13.92	0 1 0 1
42	India	766	0.016	0.022	0.126	26.50	0.61	0.20	0.81	8.52	6.78	0.079	30.86	0 1 0 1
43	Israel	3477	0.033	0.222	0.711	30.00	0.98	0.48	1.46	81.63	98.45	0.837	16.62	0 1 1 0
44	Brazil	1784	0.024	0.089	0.157	33.00	0.95	0.11	1.06	320.86	685.02	3.991	32.28	0 1 1 0
45	S. Africa	2191	0.011	0.089	0.522	41.20	0.89	0.15	1.04	12.64	3.16	0.101	4.05	0 1 1 1
46	New Zeal.	7960	0.011	0.200	0.532	48.50	1.08	0.73	1.81	11.65	4.14	0.096	0.00	0 1 1 1
47	Bolivia	1148	0.013	0.733	0.476	11.50	0.64	0.12	0.76	700.19	2616.43	11.338	37.36	1 0 0 0
48	Peru	2019	0.001	0.489	0.351	22.17	0.83	0.15	0.98	627.75	1779.70	8.839	43.59	1 0 0 0
49	Nicaragua	1606	-0.007	0.330	0.590	15.43	0.66	0.07	0.73	767.70	2530.68	11.639	2124.60	1 0 0 0
50	Guatemal	1660	0.009	0.422	0.370	14.17	0.45	0.07	0.52	12.40	10.55	0.117	21.05	1 0 0 1
51	El Salvad.	1427	0.009	0.400	0.561	13.67	0.80	0.11	0.91	15.02	7.76	0.129	58.22	1 0 0 1
52	Syria	1575	0.030	0.333	0.424	9.00	0.65	0.16	0.81	16.67	13.50	0.155	108.44	1 0 0 1
53	Indonesia	638	0.037	0.556	0.364	15.00	0.67	0.06	0.73	13.03	9.19	0.118	737.30	1 0 0 1
54	Morocco	815	0.031	0.444	0.463	11.80	0.47	0.05	0.52	7.96	3.98	0.068	9.14	1 0 0 1
55	Honduras	1039	0.009	0.356	0.598	15.17	0.67	0.08	0.75	8.04	5.37	0.072	85.83	1 0 0 1
56	Greece	2093	0.038	0.800	0.385	25.50	1.05	0.41	1.46	16.77	6.30	0.139	6.93	1 0 1 1
57	Jamaica	1773	0.010	0.422	0.847	18.53	0.82	0.43	1.25	16.80	9.17	0.146	19.93	1 0 1 1
58	Venezuel	6338	0.003	0.311	0.447	23.67	1.00	0.21	1.21	16.75	18.65	0.168	33.52	1 0 1 1
59	Panama	1575	0.023	0.276	0.799	17.33	0.96	0.29	1.25	4.47	4.41	0.043	0.00	1 0 1 1
60	Malta	1374	0.054	0.472	1.508	24.33	1.26	0.21	1.47	4.53	4.59	0.044	3.21	1 0 1 1
61	Jordan	1162	0.031	0.667	1.273	15.33	0.77	0.25	1.02	9.43	6.47	0.085	3.72	1 0 1 1
62	Sri Lanka	1259	0.018	0.400	0.672	23.83	0.95	0.27	1.22	10.64	6.69	0.094	61.15	1 0 1 1
63	Ecuador	1461	0.021	0.844	0.430	32.33	0.83	0.12	0.95	25.09	18.76	0.230	22.05	1 1 0 0
64	Thailand	943	0.045	1.000	0.440	30.87	0.83	0.12	0.95	7.21	6.35	0.068	0.25	1 1 0 1
65	Botswana	535	0.049	0.356	0.976	33.00	0.42	0.01	0.43	11.07	2.18	0.087	10.19	1 1 0 1
66	Iceland	4964	0.029	0.820	0.779	46.50	1.02	0.61	1.63	34.48	18.89	0.300	0.00	1 1 1 0
67	Chile	2885	0.016	0.422	0.403	36.33	1.09	0.24	1.33	97.64	145.64	1.067	44.79	1 1 1 0
68	Costa Rica	2096	0.017	0.422	0.646	27.83	0.96	0.21	1.17	19.16	19.23	0.187	55.99	1 1 1 0
69	Italy	4564	0.032	0.800	0.350	38.17	1.11	0.34	1.45	11.98	5.69	0.102	0.00	1 1 1 1
70	Spain	3123	0.036	0.778	0.306	41.67	1.10	0.23	1.33	12.23	5.14	0.103	0.00	1 1 1 1
71	Portugal	1869	0.046	0.778	0.614	43.20	1.31	0.20	1.51	17.83	7.02	0.149	4.84	1 1 1 1
72	S. Korea	904	0.067	0.600	0.520	28.70	0.94	0.27	1.21	11.44	8.43	0.104	18.15	1 1 1 1
73	Hon Kong	2247	0.062	1.000	1.830	49.00	0.87	0.24	1.11	8.41	4.50	0.073	-0.53	1 1 1 1
74	Ireland	3311	0.033	0.644	0.940	45.33	1.10	0.35	1.45	10.80	6.19	0.094	0.00	1 1 1 1
75	Australia	7782	0.019	0.689	0.314	46.50	1.03	0.51	1.54	9.29	2.99	0.076	0.00	1 1 1 1
76	France	5823	0.027	0.800	0.354	46.50	1.44	0.46	1.90	8.00	3.78	0.068	0.00	1 1 1 1
77	Canada	7258	0.025	0.956	0.452	47.00	1.04	0.52	1.56	7.02	2.96	0.059	0.00	1 1 1 1
78	Finland	5291	0.026	0.778	0.514	47.50	0.97	0.74	1.71	9.03	4.08	0.076	0.00	1 1 1 1
79	Sweden	7592	0.019	0.778	0.543	47.50	0.98	0.55	1.53	8.43	2.55	0.068	0.00	1 1 1 1
80	Denmark	6760	0.023	0.778	0.624	47.50	1.03	0.65	1.68	7.90	3.39	0.066	0.00	1 1 1 1
81	Belgium	5495	0.028	0.778	0.992	47.50	1.09	0.69	1.78	5.99	3.29	0.052	0.00	1 1 1 1
82	UK	6823	0.019	0.778	0.476	48.00	0.95	0.67	1.62	10.19	5.55	0.088	0.00	1 1 1 1
83	Austria	5143	0.029	0.778	0.630	48.00	1.05	0.50	1.55	4.91	2.34	0.042	0.00	1 1 1 1
84	Norway	5610	0.032	0.778	0.841	48.50	1.18	0.53	1.71	8.04	2.54	0.065	0.00	1 1 1 1
85														